

# ABSTRACT

A vertical bipolar transistor having low breakdown voltage, low ESD clamping voltage and high beta is fabricated in a semiconductor 301 of a first conductivity type, which has a buried layer 360 of the opposite conductivity type with sharp junctions, suitable as collector. This layer extends laterally to deep wells 371 of the opposite conductivity type, thus isolating the sub-surface band 301a of the semiconductor of the first conductivity type. This band is suitable as the base and has a width 301c controlled by the proximity of the buried layer junction 360a. The emitter 310 is supplied by a surface region of the opposite conductivity type.

The photomask, which is needed for implanting the low energy ions to create the extended emitter, is also used for the process step of implanting, at high energy and high dose, the ions needed (opposite conductivity type) to create the buried layer. This economical feature renders the additional high-energy ion implant step and thus the formation of an electrically isolated high-voltage I/O transistor exceedingly inexpensive.